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	Long Method	Approximate Method	Usual Method
Median	83.53	83.95	83.71
Lower quartile	75.61	75.84	75.64
Upper quartile	91.82	92.06	91.79

The usual method gives substantially the same result as the long one and a better result than the approximate method. From the nature of experimental work, great refinement in statistical treatment is often a waste of effort, and without questioning the value of Dr. Pearl's suggestion in cases in which the greatest accuracy is warranted it appears that the simple formula is still adequate for most practical purposes.

SEWALL WRIGHT

BUREAU OF ANIMAL INDUSTRY,
March 12, 1917

CHARACTERS INDICATIVE OF THE NUMBER OF SOMATIC CHROMOSOMES PRESENT IN ŒNOTHERA MUTANTS AND HYBRIDS

THE pollen grains of 28-chromosome *Œnothera Lamarckiana gigas* de Vries were long ago shown (Lutz, '09)[1] to be characteristically 3 + -lobed (chiefly 4-), instead of 3-lobed, as in *O. Lamarckiana* and other diploid forms. Gates has since contributed much to our knowledge of this subject. Recently Bartlett ('15)[2], in discussing the 3 + -lobed condition of the pollen of 28-chromosome *O. stenomeres* mut. *gigas,* stated that these 3 + -lobed grains "are larger than the triangular grains of the type" (*O. stenomeres*). It may be added that the largest, best-appearing 3- of tetraploid forms in general, is larger than the typical, best-appearing 3- of diploid, and the largest, best-appearing 3 + - of the former, larger than the typical, occasional 3 + - of the latter. Smaller 3- and 3 + - grains are found in the pollen of both, but they are rarely perfect-appearing, and it is doubtful whether slightly imperfect-appearing grains are capable of functioning. A careful examination of the adult characters of a form, together with a microscopical examination of the pollen of 10–15 buds from different parts of the plant will enable one to estimate its probable somatic chromosome number; this estimate becomes more trustworthy when one considers also (using *Lamarckiana* as the standard for comparison) the number of seeds produced per fruit by selfed flowers, the percentage of seeds which germinate, and the hereditary behavior of the plant.

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[1] Notes on the first generation hybrids of *Œnothera lata* × *O. gigas*, *Science,* N. S., 29: 263–267. Gates (Pollen development in hybrids of *Œnothera lata* × *O. Lamarckiana, Bot. Gaz.,* XLIII, 81–115, Feb., 1907) had earlier observed 3 + -lobed grains in the pollen of a triploid form.

[2] "The Mutations of *Œnothera stenomeres,*" *Amer. Jour. Bot.,* 2: 100–109.

I

All parts, or most parts, slender; pollen consisting of small, 3-lobed grains with an occasional 3 + -. Plant will probably be found to be diploid, or approximately so, having 14 or 15, possibly 16, chromosomes.

A. Abundance of pollen, 50 per cent. or more of the grains good-appearing. Abundance of seed secured from selfed flowers, germinating about as for *O. Lamarckiana* when sown in soil; all offspring, with the exception of a few mutants, duplicating the characters of the parent. Plant will probably have 14 chromosomes.

B. (*a*) Anthers barren as for *Lamarckiana lata*, or (*b*) variable amounts of pollen produced in different buds of same plant; entirely absent in some, present in small quantities or in moderate amounts in others. In best buds, imperfect-appearing grains considerably in excess of good-appearing; in others, greatly in excess of them and in still others, very few good-appearing grains. Fewer seeds obtained from selfed flowers than from an equal number of selfed *Lamarckiana* flowers; lower percentage capable of germinating, when sown in soil, than is usual for *Lamarckiana* seeds. Plant will probably have 15, possibly 14^{+1}, or even 16, chromosomes.

II

Plants intermediate between *O. Lamarckiana* and *O. Lamarckiana gigas* in stoutness of all parts; pollen absent, present in small quantities, or in moderate amounts, much as for I *B* (*a*) and (*b*). Pollen containing a mixture of 3- and 3 + -lobed grains, the former exceeding the latter in number. Largest grains larger than typical, best-appearing grains of diploid forms; relatively few of the grains good-appearing, even in best buds. Selfed flowers produce no seeds or very few; when seeds are sown in soil, very small percentage germinate. Plant probably triploid, or approximately so; probably 21-chromosome form if offspring of selfed 14-chromosome plant, or of 14 x 28; possibly 20 or 22 chromosomes. If produced by a selfed 15-chromosome form, or by 15 x 28, the chances of its having 22 are greatly enhanced.

III

All parts stouter than for triploid forms; pollen grains characteristically 3 + -lobed, with relatively few 3-lobed (typical grain 4-). Largest and best-appearing 3- and 3 + -lobed grains larger than typical, best-appearing 3- and occasional 3 + -lobed grains of diploid forms; 40 per cent. or fewer, good-appearing. Moderate amount of seed obtained from selfed flowers. Seeds large, germinate quickly. Plant will probably have 28 chromosomes, particularly if an offspring of a 14- or a 28-chromosome form, selfed, or of a 14 x 28. If the product of 15 x 28, it may have 28, 29, or even 30, chromosomes, I. Forms which are approximately, but not precisely, tetraploid, may be wholly male-sterile.

These statements are not intended to imply that all diploid, triploid and tetraploid forms have the characters enumerated above, but merely that forms displaying certain pollen conditions and vegetative characters will *probably* (by no means certainly) have the number of chromosomes specified.

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ON THE PERIODIC SHOREWARD MIGRATIONS OF TROPICAL NUDIBRANCHS[1]

MANY northern gastropods, including nudibranchs, are well known to exhibit the habit of congregating in shallow water along the shore at their time of breeding. This has been commonly interpreted as the result of migration from deeper water at the approach of the egg-laying season. Certain species, at any event, are from time to time found in great quantity at shore stations which they do not frequent at other periods, and field observations have apparently established beyond a doubt that this inshore appearance is closely connected with mating and oviposition. The migration into shallow water, or other means which accomplishes the shallow-water flocking in these cases, may be regarded as a device which insures the concentration of individuals within a relatively small area, thus tending to make more certain the chances of pairing in a large number of instances, as well as a method of determining favorable conditions for larval development.

Collectors of nudibranchs who have worked in tropical waters have also reported cases which at first sight seem to afford additional examples of the coincidence of the spawning period with appearance in great numbers in the littoral zone (*e. g.*, Crossland, quoted by Eliot, 1904, p. 87). While engaged in working along the shore during a period of some days or weeks, it is

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[1] Contributions from the Bermuda Biological Station for Research, No. 59.